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GAS ABSTRACTS

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1. GAS INDUSTRY

American Gas Association

Bridge, A. F. AMERICAN GAS ASSOCIATION TESTING LABORATORIES EXPERIENCE RECORD YEAR. *Gas Age* **103**, 43, 74-76 (1949) *January* 6.

Expenditures for the testing, inspection and requirements activities of the American Gas Association Testing Laboratories amounted to $615,000 during 1948, while expenditures on PAR research assignments totaled $182,000. New American Standard approval requirements were adopted for a number of appliances. A building was purchased in Los Angeles for a testing laboratory. Research projects on kitchen ventilation, modulated operation of forced air furnaces, installation of such furnaces in confined spaces and technical aspects of heat transfer were studied and bulletins will soon be forthcoming. Work in progress includes studies concerned with pilot thermal elements, temperature and pressure relief devices, pilot design, large single-port burners, burner flexibility and flame impingement. Recently initiated projects include studies of the design of nonaerated burners, condensation in water heaters and various methods of cooking. A series of technical reports has been undertaken on the mixing and interchangeability of gases and the first bulletin of the series has been published. Work for the commercial field has been focused on improvements in counter appliances such as coffee urns, steam tables and dry food warmers.

Franck, B. T. INDUSTRIAL AND COMMERCIAL ACCOMPLISHMENTS AND PLANS. *Gas Age* **103**, 33-36, 69 (1949) *January* 6.

The accomplishments made during 1948 in the development of industrial and commercial gas equipment are highlighted. New equipment installed for the automotive industry included special gas-fired radiant tube furnaces for controlled atmosphere cycle annealing, gas-fired forging furnaces for rapid billet heating, and convection-type ovens for curing and baking finishes. A new oven was developed to apply latex to cotton and rayon tire fabrics. Gas found increasing use in the steel processing and textile industries among others. Among the new pieces of commercial equipment were a display-type oven employing radiant gas burners, a small steam cooker and a portable food warmer. The promotional activities of the American Gas Asscciation are discussed in detail.

J. C. Lane

Fraser, W. R. THE TECHNICAL SECTION —PRODUCTION AND DISTRIBUTION ACTIVITIES. *Gas Age* **103**, 41-42, 78 (1949) *January* 6.

The Technical Section of the American Gas Association functions by means of several main committees which in turn supervise a number of subcommittees. The Chemical Committee is considering problems on laboratory analysis, calorimetry, coal expansion, odorization, tar dehydration, safety and new industrial developments. The newly formed Corrosion Committee has four subcommittees; namely, Causes of Metal Corrosion, Underground Mitigation Practices, Above-Ground Mitigation Practices, and Instrumentation. The principal subcommittees of the Distribution Committee deal with meters, cast iron pipe standards, design, development, construction and maintenance. The Committee on the Operation of Public Utility Motor vehicles is studying, among other subjects, the development and possible standardization of truck bodies. The Purging Committee is revising the Association's purging procedures and will publish a liquefied petroleum gas purging procedure early this year. The Gas Production Committee, now a part of the Manufactured Gas Department, is planning work on oven operations, supplemental gas manufacture, and a supervisory development plan for key personnel, in addition to a study of oxygen production by the Subcommittee on the Use of Oxygen.

J. C. Lane

Appliance Marketing

Jacobs, W. M. WE MUST SELL AS NEVER BEFORE. *Gas Age* **103**, 37-40, 70, 72, 74 (1949) *January* 6.

While 1948 showed a continued increase in sales of residential gas appliances, electrical appliance sales registered a greater percentage

increase. In 1931, 9 gas ranges were sold for each electric range; by 1946 the ratio had dropped to 3.1 to 1; while for the first 6 months of 1948 the ratio was down to 1.8 to 1. In 1946 there were 2.7 automatic gas water heaters shipped for each electric storage water heater. This ratio dropped to 1.6 to 1 in 1947 and was down to 1.4 to 1 during the first 6 months of 1948. A recent survey indicates that gas company sales personnel is numerically about 50% smaller than that employed during the prewar period. The American Gas Association sales training course is being used by only 75 gas companies. The facilities available to gas companies for effective sales promotion are described and past, present and future promotional activities are explained. The Residential Gas Section can and will cooperate with gas companies to convince customers that "Gas Has Got It."

J. C. Lane

Institute of Gas Technology

Pettyjohn, E. S. RESEARCH IN PROGRESS AND IN PROSPECT. *Gas Age* **103**, 44-47, 76, 78 (1949) *January* 6.

The Institute of Gas Technology has provided research facilities and skilled research workers for a major portion of the Gas Production Research program sponsored as part of the PAR plan of the American Gas Association. The Institute's participation in this program is described in a review of the research projects in progress or in preparation. The initial research project established at the Institute was the study of the catalytic gasification of propane to produce a carrier gas consisting largely of carbon monoxide and hydrogen which could then be cold enriched with additional propane to provide a substitutable, intermediate-gravity 530-540 Btu gas for peak load shaving. Begun as a library search in December 1944, the project has been carried through a laboratory study into pilot plant operation. The project has been extended to include the gasification of hydrocarbons other than propane; and, to date, natural gas, refinery oil gas, butane, condensate gasoline, straight-run gasoline, cracked gasoline and light gas oils have been catalytically gasified successfully. Three peak load plants are now in operation and others are building or planned. The study of catalysts for gaseous reactions, originally conceived to develop sulfur-resistant catalysts, was directed toward catalytic gasification of hydrocarbons while that process was being studied in the pilot plant. Nickel oxide was demonstrated to be an effective catalyst and the addition of air with the steam was established as effective in minimizing carbon deposition and in providing some of the heat required for the endothermic reaction. Research is continuing on the development of catalysts which will gasify charging stocks higher in sulfur content at increased unit capacities, lower temperatures and higher pressures. Preliminary tests are planned on the water gas shift, methanation and organic sulfur conversion reactions. In the study of the gasification of intermediate and high-carbon oils by the fluidized technique, zirconite, montmorillonite, dehydrated silica gel and coke breeze have been found to be satisfactory as heat transfer media at temperatures up to 1950°F. A pilot-scale unit has been designed, parts have been fabricated, and it will soon be erected. In the coal gasification project, coal pulverized in the Institute-developed flash pulverizer-cyclonizer is gasified in suspension using oxygen-enriched air and steam. This process, employing low cost, high ash coal fines, is of particular interest to the gas user who requires a clean, intermediate heating value gas as a substitute for propane-air where natural gas is now being supplied on an interruptible basis. The Gas Production Research Committee has authorized the construction of a larger coal gasification unit, and the preliminary plans for the unit will be submitted for approval shortly. The fundamental study of the reactions of carbon with oxygen and steam is a necessary preliminary to the analysis of all gas-making reactions. The equilibria and reaction kinetics of these reactions are being studied, both at atmospheric and elevated pressures over a temperature range of 1700-2300°F. The study of the enriching value of oils has shown that the carbon-hydrogen ratio of the oil is the primary criterion for predicting enriching values, oil gas yields and composition and tar yields. Methods for estimating the C/H ratio from simple physical tests have been developed. A number of gas companies are being asked to

test these methods by comparing estimated enriching values with operating results. Research on the removal of organic sulfur compounds from fuel gases has resulted in the development of an analytical method now employed in certain gas plants where organic sulfur is a particular problem. Removal with amine-carrying oil solutions is now in progress. Initial sulfur contents of 15-20 grains have been reduced to 0.5 to 1 grain per 100 cu ft. In addition to the projects for the Gas Production Research Committee, the Institute is carrying forward a study of forced combustion in domestic cooking for the Committee on Domestic Gas Research. The Institute is also studying problems for the Natural Gas Research and Technical Advisory Committee. New facilities have been added to the coal research laboratory, and two experienced men have been employed to study the independent and dependent variables in coal carbonization. The Institute's growth has been encouraging. Total assets now exceed $1,000,000. The educational program has been reactivated after the unavoidable wartime shut-down. The hopes and ideals of the founders are being more nearly achieved at the present time than during any previous period in the Institute's short life.

J. C. Lane

LP-Gases

Drake, F. E. LIQUEFIED PETROLEUM GASES THE PERFECT FUEL FOR THE STEEL INDUSTRY. *Am. Gas J.* **170**, 29-33, 50 (1949) *January.*

The gas industry is in great need of the products of the steel industry, while the latter requires great quantities of gas to conduct its operations on an uninterrupted basis. The supply of natural gas has not been able to keep up with demand, largely from lack of adequate pipe lines, and natural gas has had to be supplied to industrial users on an interruptible basis. LP-gas installations can be used as standby plants to avoid partial or entire shut downs during peak demands for natural gas. Installation costs are low in comparison to the losses of profits and wages resulting from shutdowns. One manufacturer stated that the first four hours of operation of his LP-gas standby plant paid for the investment. Numerous statistics of both the gas industry and the steel industry are presented in the article to illustrate the importance of each industry to the other.

J. C. Lane

Supply and Requirements

Bratter, H. GAS INDUSTRY'S FOUR-YEAR OUTLOOK. *Public Utilities Fortnightly* **43**, 407-414 (1949) *March.*

The report on the outlook for the gas industry recently published by the National Security Resources Board combines the data obtained by an eight-member industry group with the information available through the Federal Power Commission and the American Gas Association to present a detailed estimate of the gas industry's supplies and requirements for the years 1948 through 1952. The cost differential between gas and oil is expected to decrease, since some long-term contracts for natural gas at 4-5 cents per thousand will expire and contract prices now range between 8 and 10 cents per thousand. Also tending to raise natural gas prices to the consumer is the increased cost of pipe line construction. A mile of 24-26 inch pipe line cost about $50,000 before the war, whereas the comparable cost today is $100,000. Cost of increased storage facilities will contribute to increased gas prices. Construction expenditures of the gas industry during the five years ending in 1952 are currently estimated at more than $3 billion, about four-fifths of which is to be spent for natural gas facilities, especially transmission. This five-year estimate is believed low, since not all expansion projects are yet foreseen and new companies are likely to be formed. However, the $3 billion expansion should be compared with the present estimated $6 billion investment in the gas utility industry. Financing the expansion is expected to be much less difficult than obtaining the necessary steel. The gas utility industry is expected to deliver about 50% more therms in 1952 than in 1947.

J. C. Lane

Falck, E. NRSB ESTIMATES TOTAL GAS INDUSTRY SUPPLY AND REQUIREMENTS 1948-1952. *Gas Age* **103**, 17-24 (1949) *March* 17.

Total utility sales of all types of gas are ex-

pected to be 50% greater in 1952 than they were in 1947. Utility sales of manufactured gas are expected to decrease 15% during the period, while utility sales of the other gases are expected to increase as follows: mixed gas, 105%; and natural gas, 55%. This installment of the National Security Resources Board report forecasts deliveries of the various types of gas in each of eight regional areas during the years 1948-1952.

J. C. Lane

Falck, E. NSRB ESTIMATES TOTAL GAS INDUSTRY SUPPLY AND REQUIREMENTS 1948-1952. *Gas Age* **103**, 27-34 (1949) *March* 31.

The second and concluding installment of this report of the National Securities Resources Board covers the following subjects: Part III—Supply and Requirements, with kinds of natural gas consumption and curtailment and restrictions of gas service; Part IV—Gas Industry Construction Program, including pipe line expansion, financial requirements and FPC certificate authorizations; Part V—Gas Industry Steel Requirements, including estimates for the period April 1, 1948 through September 30, 1949, and delivery schedules for line pipe; and Part VI—Gas Industry Fuel Requirements, including estimates of the oil and solid fuels requirements of gas utilities through 1952. Current annual pipe line requirements of the gas and oil industries total more than 4 million tons, while pipe production in 1948, the all-time record year, was about 1,725,000 tons. During the year ending September 30, 1949, the natural gas industry will require an estimated 1,425,600 tons of line pipe, and another 405,800 tons will be needed for gas manufacture and distribution, the total 1,831,400 tons exceeding last year's pipe production. In 1945, gas utilities used 934 million gallons of oil and 9,748,000 tons of solid fuels. In 1947, oil use increased to 1,239 million gallons while solid fuels use decreased to 9,460,000 tons. Oil use at the 1947 rate and coal use at the 1945 rate are forecast for 1949 with a slight increase in coal use in 1950. A marked displacement of oil by natural gas is anticipated in 1951 and 1952 when presently authorized pipe lines are completed. Oil requirements are forecast as 659 and 651 million gallons, respectively, for 1951 and 1952, while solid fuel requirements are expected to be 10,186,000 and 10,777,000 tons, respectively.

J. C. Lane

The following article, which has not been abstracted, is called to your attention:

Logan, L. J. U.S. RESERVES AT NEW PEAK. *World Oil* **128**, 52-53, 56 (1949) *April.*

2. APPLIANCES

Kitchen Ventilation

STUDY OF ACCUMULATION OF COMBUSTIBLE DEPOSITS IN KITCHEN VENTILATING SYSTEMS. *Am. Gas Assoc. Testing Laboratories Research Bull.* **49** (1948) *November.*

Grease, dust and lint depositing in and around domestic kitchen ventilating systems tend to be most concentrated at the air intakes and in the first few feet of ductwork. Accumulations of soilage may be found in decreasing amounts of duct sections leading from the range to the blower. Apparently such deposits of grease, dust and lint do not create a fire hazard, even when subjected to temperatures higher than those normally encountered in range operation. In domestic kitchens equipped with mechanical ventilating systems, wall cabinets located directly above the range seem to become more heavily soiled than cabinets placed on either side of the range. While a somewhat similar trend may be observed in a kitchen not equipped with mechanical means for ventilation, grease and dust appear to deposit more uniformly throughout the kitchen than in a mechanically ventilated kitchen. Location of heaviest soilage in various parts of a ventilated or non-ventilated kitchen is apparently dependent to some extent on the type of wall surface employed.

Excerpt from bulletin

Ranges

Bauer, W. (Assigned to Tappan Stove Co.) GAS RANGE TOP UNIT. U.S. 2,466,979 (1949) April 12.

A patent has been granted for a gas range top burner with a grate flush with the range top.

A secondary vent for the combustion products is employed when the pan covers the entire grate area. A series of concentric cylinders are employed to cool the adjacent range top by passing secondary air through the annular space.

E. F. Davis

INVESTIGATION OF FACTORS AFFECTING HEIGHT OF GAS RANGE GRATES. *Am. Gas Assoc. Testing Laboratories Research Bull.* 52, (1948) *November.*

With partial or total venting of the top burner flue products it is possible to provide satisfactory combustion and top burner thermal efficiency with grate heights varying from zero to ¼ in. above the top surface. A grate height of ¼ in. appears optimum from an over-all consideration of combustion, thermal efficiency, and surface temperature. However, since top burner performance was not studied in conjunction with a broiler or oven burner in operation a grate height of ¼ in. would not necessarily be optimum for practical operating conditions.

E. F. Davis

RESEARCH IN RANGE TOP BURNER IGNITION AT REDUCED GAS INPUT RATES. *Am. Gas Assoc. Testing Laboratories Research Bull* 50 (1948) *November.*

From results of this investigation it appears that ignition (or reignition) of single and dual type top burners is not completely effective on contemporary range designs on either natural or manufactured gas, when these top burners are operated at input rates of less than about 46% of full rating (9,000 Btu per hr) with gas supplied to all burner ports. It appears that automatic ignition can be effected at as low as 17% of a full rate of 9,000 Btu per hour with natural gas and 15.5% of full rate with manufactured gas, provided the flash tube is designed with this objective in mind, when gas is supplied to all burner ports. Such features as oval ends of the flash tube at the lighter port end, a slight inclination of the flash tube toward the pilot, and a stack effect above the pilot burner seem to be significant in designing a flash tube system for obtaining ignition at a low top burner input rate. It also appears possible to obtain automatic top burner ignition at input rates as low as 11% of full rate with manufactured gas and 15% of full rate with natural gas if the main burner gas valve, main burner lighter port, and flash tube are specially designed for this purpose as in this investigation. Rates of this magnitude approximate the minimum practical adjustment in service attained with most contemporary range top burners. Effectiveness of this latter system depends, however, on a separate gas supply line from a modified dual burner valve to the main burner lighter port to provide for full lighter port rating at all times when the main burner is in operation.

Author's conclusions

Space Heating

Ridder, H. FUEL OIL—OIL VS. GAS HEAT. *Natl. Petroleum News* 41, 38 (1949) *March* 30. Oil dealers are urged to improve oil burner heating installations to increase thermal efficiency, cooperate with each other on price of fuel oil and installation requirements, and compile figures to show the cost of heat delivered by gas as compared with fuel oil. It is stated that oil heat can be made more efficient than gas since, due to poor installation of gas heating units, lower efficiencies result.

E. F. Davis

EFFECTS OF CONFINED SPACE INSTALLATION ON CENTRAL GAS SPACE HEATING EQUIPMENT PERFORMANCE. *Am. Gas Assoc. Testing Laboratories Research Bull.* 53 (1949) *February.*

Central gas space heating equipment can be safely employed in confined spaces provided these recommendations are followed: (1) Two air inlets must be provided into the space, each having an opening of 1 sq in/1000 Btu/hr of furnace rated input. One opening must be below the level of the combustion air intake, the other above the level of the draft hood relief opening and in no case should they be closer than 3½ ft. The inlets must be connected to a space where adequate air is available on to the out-

side of the building. (2) A minimum of two feet must be provided between the front of the furnace and the access door to the confined space. (3) The furnaces must be spaced at least six inches from other surrounding walls. (4) A vent cowl must be provided which will prevent down drafts in the flue and eliminate spillage of combustion products in the confined space.

E. F. Davis

THE EFFECTS OF MODULATED OPERATION ON PERFORMANCE OF GAS WARM AIR FURNACES. *Am. Gas Assoc. Testing Laboratories Bull.* **51** (1948) *November.*

Gas fired forced or gravity warm air heating plants can be operated at approximately 5% of the manufacturers rated input with only a slight decrease in thermal efficiency and with stable flames and satisfactory combustion. Short cycling of the main burner can be satisfactorily accomplished; however, in some cases the noise of extinction was objectionable.

E. F. Davis

PERFORMANCE OF HEATING PANEL STUDIED. *Heating, Piping & Air Conditioning* **21**, 112-114 (1949) *April.*

The heat flow through concrete radiant panel slabs is being investigated by placing a test slab between two controlled heat absorbing materials to form a sandwich. As yet no analytical method has been devised to check the test results even though the data appears to conform with the general theory. First tests show that nearly twice as much heat will flow from the slab surface when pipes are spaced on 4 inch centers instead of 12 inch centers.

E. F. Davis

WHOLE-HOUSE HEATING — AN IMAGINATIVE SOCIAL SERVICE. *Gas J.* (British) **258**, 46-47 (1949) *April* 6.

Two identical houses at Stanmore, Middlesex have been built and equipped with two separate types of central heating systems. One house employs a gas fired warm air unit which can be used for direct air heating or indirect panel heating. The other house employs a solid fuel furnace which delivers hot air or hot water for heating. As yet no test results are available but it is reported that the temperature variation in a horizontal plane in any room does not vary over 2°F, while in vertical planes the variations have been from 2° to 6°F.

E. F. Davis

The following article, the abstract for which appears on the page indicated, is also called to your attention:
Jacobs, W. M. WE MUST SELL AS NEVER BEFORE. p. 93.

3. COMBUSTION AND INDUSTRIAL FURNACES

Combustion

Badin, E. J., Stuart, J. G., and Pease, R. N. BURNING VELOCITIES OF BUTADIENE-1,3 WITH NITROGEN-OXYGEN AND HELIUM OXYGEN MIXTURES. *J. Chem. Phys.* **17**, 314-316 (1949) *March.*

The maximum burning velocity of butadiene-1,3 with "helium air" (79% helium, 21% oxygen) is 3.7 times that for butadiene-1,3 with air at atmospheric pressure and the maximum burning velocity is found at 300 mm. Hg pressure. These data appear to confirm the theory of Tanford and Pease that the burning velocity is controlled by the rate of back-diffusion of H atoms from the flame front into the unburned gas. Thus, the increased burning velocity with "helium air" is due to the higher diffusion coefficient in helium mixtures and the increase at reduced pressures is due to the greater mean free path.

A. J. Rudnitzki

Davey, W. J. G. INTERPRETATION OF GAS ANALYSES—IV. FURTHER USES OF THE TRIANGULAR CO-ORDINATE CHART. *Gas World* (British) **130**, 438-443 (1949) *March* 12.

A method is given for determining heating value and specific gravity of all combinations of three component gases. A method is also shown for plotting the Aeration Test Burner number, thereby defining the flame characteris-

tics for various mixtures.

E. F. Davis

Taylor, J. and Pollok, F. EFFECT OF VARIOUS CHEMICALS, MORE PARTICULARLY SODIUM BICARBONATE, ON THE IGNITION OF CELLULOSE, COAL DUST AND ACTIVATED CHARCOAL. *Fuel* (British) **28**, 77-87 (1949) *April*.

Experimental work on the effect of a variety of chemicals on the ignition and combustion of cellulose is described. Pure cotton cellulose in the form of ash-free filter paper when heated in an air bath showed incipient decomposition at about 200°C. and ignited at about 340°C. When sodium bicarbonate was in contact with the paper, marked decomposition occurred with smoldering at about 200°C. In tests with about 400 chemicals, which are listed and classified, all those which promoted smoldering lowered the ignition or smoldering point to about 200°C., but the rate at which they caused decomposition of the cellulose varied. Oxidizing agents lowered the ignition point below 200°C. In tests in a different apparatus the ignition points of bituminous coal dust and activated charcoal were lowered in the presence of sodium bicarbonate. A literature survey of investigations on the ignition of cellulose, coal dust and activated charcoal is given.

Authors' abstract

Victory, H. J. DEVELOPMENT OF A POSSIBLE METHOD OF ESTIMATING THE EXCESS AIR USED IN COMBUSTION OF BLAST FURNACE AND COKE OVEN GAS FROM A KNOWLEDGE OF THE GROSS CALORIFIC VALUE OF THE FUEL AND THE CARBON DIOXIDE CONTENT OF THE WASTE GASES. *Gas World* (British) **130**, *Supplement* 27-44 (1949) *April* 2.

From a study of a large number of gas analyses (12 tables, 11 figures), the author confirms the existence of straight line relationships between calorific value, excess air, waste gas volume and carbon dioxide content. From the data a set of curves may be constructed for routine fuel control. The relationships hold more generally for blast furnace gas than for coke oven gases.

O. P. Brysch

Drying

Taylor, J. N. INDUSTRIAL STOVING OVENS. *Ind. Finishing* (British) **1949**, 398-410 (*February*).

A general description of batch, and continuous ovens of the convection and radiant type is given. Only those ovens employed for industrial drying were considered.

E. F. Davis

Furnace Design

Holden, A. H. NOTES ON INDUSTRIAL FURNACE DESIGN. *Gas Heat in Industry* (British) **1949**, 141-142, 144, 146, 148, 150 (1949) *February*.

General comments are given on strand, belt, walking beam, and pusher types of continuous furnaces.

E. F. Davis

Utilization

Dickinson, F. COMMERCIAL AND INDUSTRIAL UTILIZATION OF GAS. 10. SPACE HEATING. *Gas J.* (British) **257**, 534-536, 539-542 (1949) *March* 9.

The methods for sizing space heating units to homes as well as to factories and large buildings is discussed.

E. F. Davis

Dickinson, F. COMMERCIAL AND INDUSTRIAL UTILIZATION OF GAS. 11. TEMPERATURE MEASUREMENT, CONTROL, AND PROTECTIVE EQUIPMENT. *Gas J.* (British) **257**, 588-590 (1949) *March* 6.

Of use to all industrial gas men are the limits to which temperature indicating, controlling and recording devices can be successfully employed. There is no thermosensitive device which will withstand temperatures as high as 3000°F for long periods of time, particularly in a reducing atmosphere. 85% platinum, 13% rhodium thermocouples, when protected, can be used continuously at temperatures up to 2,700°F. The various types of control and safe-

ty devices are discussed and reasons for their use are explained.

E. F. Davis

4. CARBONIZATION AND GASIFICATION

Ammonia Synthesis

SYNTHETIC AMMONIA FROM COKE-OVEN GAS. *Coke & Gas* (British) **10**, 391-396 (1948) *November.*

Coke oven gas cleaned of light oil, water vapor, and CO_2 is cooled to —180°C for the removal of methane as liquid. The remaining gases containing essentially hydrogen are combined with nitrogen from an air separation plant for the preparation of an ammonia synthesis gas. Compressed to 250 atm and further cleaned by oil scrubbing, the synthesis gas enters an ammonia reaction vessel operating with an iron oxide catalyst at approximately 250°C. Ammonium sulfate is produced from the synthetic ammonia by reaction with sulfuric acid in standard lead lined saturators.

C. Von Fredersdorff

Briquets

Bardsley, N. COKE BREEZE BRIQUETTING. *Gas* (British) **3**, 227-238 (1948) *December.*

Breeze priced at 37% of large-size coke has been briquetted by roll-press with 12% pitch at 1½ tons per sq in. at a rate of 2¾ tons per hr. Final calorific value is 12,500 Btu per lb and ash content is 12%. They are used as boiler, locomotive, producer and closed-stove fuels. Total cost, including financing is 47s ($11.28) per ton, at full rate of production (5 tons/hr), and the market price is 69s ($16.56) per ton.

O. P. Brysch

Bulk Density

Reif, A. E. THE LUMP DENSITY OF COKE. *J. Inst. Fuel* (British) **22**, 24-31 (1948) *October.*

Various methods of bulk density determination are discussed, including immersion in solid, liquid and gaseous media, solidification methods and geometric methods. Impregnating the surface of a porous solid with gelatin so as to seal off the pores prior to the determination of bulk density by water displacement is recommended as a correct procedure. A comparison between methods is given.

C. Von Fredersdorff

Carbonization

Roberts, J. OXIDATION AND PREHEATING SYSTEMS OF COAL CARBONIZATION. *Coke & Gas* (British) **10**, 377-379 (1948) *November.*

The author outlines past and present procedures for preheating, oxidizing, and blending oxidized and raw coal to eliminate sticking on walls of stationary or rotating retorts in the production of low temperature coke.

C. Von Fredersdorff

Catalytic Gasification

Loughry, T. F. THE CRACKING OF GASOLINE FOR GASEOUS FUEL. *Gas Age* **103**, 33-34, 62, 64, 66, 68 (1949) *March* 17.

Surface Combustion Corporation's catalytic cracking process using gasoline for fuel gas production is discussed. The essential justification for the catalytic process is its unique ability to vary heating value and specific gravity over wide limits to produce gases interchangeable with the gas obtained from normal sources. Five operations are necessary to process gasoline into final gas. (1) Fractional distillation of casinghead or straight-run gasolines produces a light fraction (hexanes and lighter) for enriching, an intermediate fraction (octanes to hexanes) for feed to the catalytic cracking operation and a heavy or residue fraction used as fuel. (2) The intermediate fraction is mixed with steam and air in predetermined amounts. (3) The steam-air-hydrocarbon mixture is passed over a nickel catalyst at 1650 to 1800°F to produce a carrier gas ranging in specific gravity from 0.35 to 0.70 and in heating value from 380 to 180 Btu per cu ft. (4) The reaction products are cooled by direct contact with water producing the cooled carrier gas; no carbon or condensable vapors remain so there is no effluent problem. (5) Enriching of the carrier gas

with the light fraction is accomplished automatically. The above process cannot be used to make 520 to 540 Btu per cu ft gas if main temperatures fall below 40°F and main pressures exceed 7 to 8 pounds because of condensation of the enriching agent. The process outlined cannot be used at all for 1000 Btu gases. Process air, steam and gasoline requirements for the production of (a) 540 Btu, 0.67 gravity, and (b) 520 Btu, 0.52 gravity gases are presented.

C. H. Riesz

Stark, V. METHOD AND APPARATUS FOR PRODUCING HEATING GAS. U.S. 2,465,666 (1949) March 29.

Gases for heating purposes are produced by cracking oil in the presence of steam. The mixture of oil and steam is passed from the center of a cylindrical alloy reactor to the periphery through at least four concentrically disposed tubular alloy baffles. The outermost concentric annuli may be filled with a catalyst (nickel type specified). Since heat is supplied to the exterior of the reactor, the steam-oil mixture is subjected to progressively increasing temperatures while distributed in layers of increasing area and volume. Formation of carbon monoxide and hydrogen along with the lower hydrocarbon gases produces a gas mixture of desired heating value, e.g. 550, 1000 or 1500 Btu per cu ft. Bunker C oil may be used, 10 gallons being required to produce one Mcf of 1100 Btu per cu ft gas.

C. H. Riesz

Coal Blending

Savage, P. S. THE BLENDING OF COALS TO IMPROVE COKE AND EXTEND COKING COAL RESERVES. *Blast Furnace Steel Plant* **37**, 323-324, 334 (1949) *March.*

A merchant coke producer cites his successful experience since 1930 with blending of as high as 4% anthrafines, or 10% Pennsylvania strip low volatile or 20% strip high volatile substandard coals in his oven charges. This was done by careful attention to mixing (from 6 bins), fine pulverization, and oil treatment. His experience indicates that these "inert"-type coals can replace equal percentages of good Pocahontas coal in the mix without injuring coke quality. He suggests the use of 6 to 8 mixer bins to enable flexible blending practice of such "bargain" priced coal, thereby conserving the better grades for future reserves and broadening the source of supply. Modern conveyor systems have eliminated the need for the large costly oven-bin, but not the mixing bins. The author suggests that such blending practice form a basis for conservation of coking coals which can be agreed upon by the coal and the coking industries.

O. P. Brysch

Coal Selection

Barker, F. C. COALS FOR THE MIDLAND GAS UNDERTAKINGS. *Gas* (British) **3**, 203-219 (1948) *December.*

Technical and economic considerations governing coal quality are briefly reviewed from the standpoint of suitability, classification, source of supply and control.

O. P. Brysch

Coke Ovens

EXPANSION EFFECTS IN COKE-OVEN BATTERIES. *Coke & Gas* (British) **11**, 101-107 (1949) *March.*

The use of semi-silica refractories to replace silica in below-oven-floor construction has been proposed for effecting a reduction in the capital cost. This imposes the problem of differential expansion of the two materials, with resultant damage to walls of regenerators with severe loss of heating efficiency. M. C. Petit of the Belgian Coppée Company has measured the temperatures in the silica above and the semi-silica below the dividing plane at which differential expansion and sliding strains take place. From these temperatures and from laboratory expansion data on the materials, a temperature-differential curve is constructed, from which the expansion of the semi-silica can be found for a given silica temperature. The difference in expansion between silica and subjacent semi-silica when plotted against temperature shows

but little differential expansion after 500°C is reached. This curve checked well with expansion data (coke to pusher side) observed in heating up of batteries of both materials. Coppée holds the lower semi-silica in position by a steel bar (12″ x 1½″) lengthwise of each side at top of regenerators, bound from coke-to-pusher side by 2″ diameter bolts. After 500°C is reached the bolts are removed, as the expansion rate has become equal in the top and bottom materials. The silica superstructure has its own independent set of buckstays and tie rods and is controlled in the usual way. This system of control of differential expansion has been used successfully in heating up of 17 batteries comprising 531 ovens.

O. P. Brysch

Corrosion

Kulman, F. E. CORROSION CONTROL OF HIGH PRESSURE GAS DISTRIBUTION SYSTEM. Paper presented at the Am. Gas Assoc. Distribution, Motor Vehicle, and Corrosion Conference, Cincinnati, Ohio, April 4-6, 1949.

This paper is a description of the corrosion experience obtained from a city distribution system and the various measures that have been taken for corrosion control. Underground corrosion is considered to be an electro-biochemical process. The use of selected backfills, insulating couplings, coated pipe, and cathodic protection for protection from electrolysis are discussed. A statistical study of some 470 leak sites indicated that biological factors were important. An investigation of these factors has been commenced and the preliminary results are reported.

B. E. Hunt

Dust Problems

Wiseman, A. J. S. DUST PROBLEMS IN GAS WORKS PRACTICE. *Gas World* (British) 506-510 (1949) *March* 26.

The author gives a general survey of the nature and magnitude of the dust problems encountered in gas manufacture, under coal handling, oven charging, water gas manufacture and atmospheric pollution. In discussing the methods of dealing with dust he briefly outlines the principles of wetting, settlement, inertia separation, electrostatic precipitation and filtration.

O. P. Brysch

Meters

Beach, F. K. HOW EXACT IS GAS METERING? *Petroleum Engr.* **21B**, 54, 56, 58 (1949) *March.*

Some of the pitfalls which cause poor metering are mentioned. These include: accumulation of liquid behind the orifice plate in horizontal meter runs; occurrence of too large a recess between the end of the pipe and the upstream face of the orifice; use of improper flanges to hold the orifices; orifice plate being off center; uncertainty as to the actual i.d. of the pipe in the meter run; accumulation of liquid in the pressure tap lines; use of orifice plates of improper thickness; mistreatment of the recorder pen; accumulation of wax in the meter; and loss of mercury.

W. J. Merwin

Moisture in Coal

Bainbridge, J. R., Scanlan, P. G. and Belyea, I. DETERMINATION OF MOISTURE IN BROWN COALS BY DISTRIBUTION. *Fuel* (British) **28**, 88-90 (1949) *April.*

The method proposed is a modification of that described in British Standard Specification 1016 (1942). Substitution of a helical downflow condenser for the standard reflux type shortens the distillation period to 2 to 2½ hours, even with high-moisture coals.

W. E. Ball

Oil Gases

Krause, A. W. and Cunningham, A. M. INTERCHANGEABILITY CHARACTERISTICS OF OIL GASES. PART I. INTERCHANGEABILITY OF OIL GAS WITH NATURAL GAS. *Gas Age* **103**, 17-21, 59-60, 62, 64 (1949) *March* 31; *Gas* **25**, 60-64 (1949) *April.*

The suitability of oil gases as substitutes for natural gas is discussed. Based on the calculated

American Gas Association interchangeability indices and on reported field experience it is concluded that (1) the most satisfactory substitute for natural gas is a 960 Btu, 0.74 specific gravity oil gas; (2) with the proper composition, oil gas may be substituted to the extent of 100%; and (3) flash back, yellow tips and odor complaints are the most likely difficulties.

A. J. Rudnitzki

Peak Load

Dormer, G. G. PEAK LOAD EXPERIENCES. *Am. Gas J.* **170**, 17-20, 50 (1949) *April.*

The experience of the Binghamton (N.Y.) Gas Works in meeting peak loads is reviewed. Costs for replacing natural gas with 1035 Btu oil gas and with propane air are estimated for various conditions.

C. H. Riesz

Producers

Charrier, M. F. GAS PRODUCER. U.S. 2,462,-720 (1949) February 22.

A gas producer is proposed which comprises two superimposed retort chambers separated by a grate-like bank of fire tubes, with the lower chamber heated by a fire box below. *Waste vegetable matter* is charged as generator fuel into both chambers and essentially is distilled, the fuel gas leaving the top of the upper chamber.

O. P. Brysch

Potter, G. H. CONTROLLED AIR BLAST ON STEP-GRATE PRODUCERS. *Gas Times* (British) **58**, 351-352 (1949) *March* 25.

In a setting of 32 Woodall-Duckham 76 inch downwardly-heated retorts heated by 4 normal coke-fired step-grate producers, improved fire conditions and gas properties were obtained by independent control of air and steam. Formerly primary air was induced by a steam venturi which was controlled according to a CO pressure-recorder. By thermostatically controlling the blast-saturation temperature to 55°C (air-steam ratio of 8.69 to 1), hard clinker was arrested, fire cleanings were reduced from 3 to 1 per 24 hrs and constant volume and calorific value of gas was obtained. This has helped to offset the ill effects of increased ash-content, higher coal through-put, lower fusing temperature of ash, and very difficult labor conditions.

O. P. Brysch

Pulverized Coal

Dobson, W. E. COKE FINES FOR STEAM RAISING. *Gas World* (British) **130**, 452-453 (1949) *March* 12.

Very successful use of coke fines ($\frac{7}{16}$" to 0") has been achieved on an Oldbury chain-grate stoker fitted to a Lancashire boiler. 57.5% boiler efficiency and 5,725 lb steam/hr output are obtained, with an annual fuel saving of ±3300 lbs. ($13,330). However, operations have required the installation of dust arrestors, flue-cleaning jets and also a recirculation flue for hot boiler-gas to ignite the coke as fed. The fire can be successfully "banked", little clinker trouble has developed, and only minor renewals of fuel-hopper doors and grate links have been needed.

O. P. Brysch

Humphreys, C. G. R. EARLY DEVELOPMENTS IN PULVERIZED-COAL FIRING. PART III. THE TRANSPORTATION FIELD. *Combustion* **20**, 40-46 (1948) *November.*

The author presents several illustrations of pulverized coal firing in marine boilers and early attempts to apply pulverized coal fired steam turbines to locomotives. Latest developments include the pulverized coal fired gas turbine as a prime mover for locomotive application.

C. Von Fredersdorff

Purification

Cooper, C. ECONOMICS OF GAS WASHING. EXPERIMENTAL CALCULATIONS. *Gas J.* (British) **257**, 645-648, 651-653 (1949) *March* 23.

The results of preliminary calculations of overall costs of gas washing operations are presented in the form of tables and graphs. The operations covered are ammonia removal (100 and 200 grains per cu ft), benzol recovery (50%,

85%, and 95%), and naphthalene removal (80% and 90% recovery). The author concludes that, in general, ammonia washers are too large, and benzol washers too small from the standpoint of overall economy. For naphthalene removal, the static type washer is preferable to the single-effect type.

W. E. Ball

Gollmar, H. A. (Assigned to Koppers Co., Inc.) GAS PURIFICATION PROCESS. U.S. 2,464,-805 (1949) March 22.

This invention relates to liquid purification processes for coke oven gas, particularly for hydrogen sulfide removal. The H_2S is scrubbed out by an alkaline aqueous solution, and the fouled solution actified by distillation at an absolute pressure of 4 in. Hg. The distinctive feature is that the heat necessary for actification is obtained from a low-temperature source, in this case from the collecting-main flushing liquor. The heat may be transferred through coils in the base of the actifier, or the flushing liquor may be flash-evaporated and the resulting vapors passed directly into the actifier. Cooling the liquor from 72°C down to 66°C reduces the temperature of the gas in the collecting main an additional 5°C, with resulting economies in the final gas cooling.

W. E. Ball

Mitchell, J. (Assigned to Koppers Co., Inc.) GAS PURIFICATION PROCESS. U.S. 2,464,-824 (1949) March 22.

The process described is similar to U.S. 2,464,-805. In this case, the heat for distillation of the absorbing solution is obtained from quenching liquor. The liquor is delivered to a reboiler, where the temperature is dropped from 185°F down to 149°F, and the resulting vapors are conducted to the hot vacuum actifier, operated at a temperature of 135°F. In the quenching tower, auxiliary sprays at a high level decrease the heat lost in the steam.

W. E. Ball

Tar Dehydration

Friederich, L. A. TAR DEHYDRATION. *Am. Gas J.* **170**, 26-27 (1949) *January.*

Industrial methods of tar dehydration for use as boiler fuel or for sale are discussed from the operator's view point.

H. R. Linden

Underground Gasification

Dahlgren, E. G. SECOND UNDERGROUND GASIFICATION PROJECT STARTS. *Gas* **25**, 40-41 (1949) *April.*

The second underground coal gasification project at Gorgas, Alabama, was scheduled to start on March 15. This project is being conducted jointly by the Bureau of Mines and the Alabama Powe. Company at a cost of $411,000 for a one-year period. The area chosen consists of 100 acres of Pratt seam coal averaging 44 in. in thickness, near the site of the initial experiment in 1947. Two parallel entries have been driven into the coal bed for a distance of 1200 ft and a single butt entry for an additional 300 ft. The fire is to be started with an incendiary bomb, after which air is to be pumped in and gases removed through five large-diameter bore holes. Since the test will be conducted at a depth of 100 ft or more and high temperatures are to be used, a gas of from 75 to 125 Btu should be produced. The process is expected to provide a cheap source of synthesis gas.

W. E. Ball

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Freeman, R. H. AUTOMATICALLY CONTROLLING DISTRICT REGULATOR STATIONS FOR HEAVY HOUSE HEATING. p. 105

Menet, W. J. EFFECT ON METERS OF THE USE OF NATURAL GAS MIXTURES IN THE GAS PRODUCTION PLANT. p. 105

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Distribution

Freeman, R. H. AUTOMATICALLY CONTROLLING DISTRICT REGULATOR STATIONS FOR HEAVY HOUSE HEATING. Paper presented at the Am. Gas Assoc. Distribution, Motor Vehicle and Corrosion Conference at Cincinnati, Ohio, April 4-6, 1949.

The successful adaptation of a commercial automatic controller to the control of system pressure in a district with heavy house heating demand is described. Attempts to build up the system pressure with various home-made devices as demand varied are described. In all cases the principle of round the block control was used to detect change in demand. In the control system employing the commercial controller the pressure at the low pressure point of the system is telemetered by a telephone circuit to a free vane commercial controller with adjustable sensitivity and automatic "reset." The output from the controller is used to reset a pilot loader which builds up the pressure in the regulating valve. The commercial controller gave improved control at a smaller initial cost than the home made devices previously used.

O. T. Bloomer

Monet. W. J. EFFECT ON METERS OF THE USE OF NATURAL GAS MIXTURES IN THE GAS PRODUCTION PLANT. Paper presented at the Am. Gas Assoc. Distribution, Motor Vehicle and Corrosion Conference, Cincinnati, Ohio, April 4-6, 1949.

Prior to 1931 the Peoples Gas Light and Coke Company of Chicago used a 75% coke oven and 25% carburetted water gas mixture and of the meters tested on a five year plan only about 55% were legally correct. Since 1931 an 800 Btu mixture with natural gas has been used and a 10 year plan for change has been adopted and nearly 90% of the meters are correct. Most of the difficulties were attributed to the condensate forming a cake in the bottom of the meter; this has not occurred since the changeover.

E. F. Davis

Sterk, H. J. PERIODIC METER CHANGE TRENDS. *Gas Age* 103, 27-29, 54, 56 (1949) *March* 3.

See *Gas Abstracts* 5, 73 (1949) *April* for abstract.

Gas Hydrates

Unruh, C. H. and Katz, D. L. GAS HYDRATES OF CARBON DIOXIDE-METHANE MIXTURES. *J. Petroleum Technol.* 1 *Trans. Sect.* 83-86 (1949) *April.*

Hydrate forming conditions for mixtures of carbon dioxide and methane were studied. K factors for carbon dioxide, defined as mole fraction of carbon dioxide in the gas phase (dry basis) divided by mole fraction of carbon dioxide in the hydrate (dry basis) were calculated for a range of temperatures and pressures. As pointed out by Rzasa in an appended discussion, the K factors for carbon dioxide were derived on the basis of K factors previously calculated for methane in certain natural gases. This condition is not strictly comparable to the presently reported system. Rzasa also points out the need for hydrate data on N_2 since not all workers believe it forms hydrates.

J. D. Parent

Natural Gasoline

Garrison, M. E. GENERAL PETROLEUM'S BURREL GASOLINE PLANT. *Gas* 25, 52-57 (1949) *April;* 80% PROPANE RECOVERY IN GASOLINE PLANT EXCEEDS ITS DESIGN FIGURE. *Petroleum Processing* 4, 395-399 (1949) *April.*

See *Gas Abstracts* 5, 74 (1949) *April* for abstract.

Glendening, A.S. and Sanderson, C. F. SHORT CUT PROCESS DESIGN TO INCREASE PROPANE RECOVERY IN GASOLINE PLANTS. IV. *Petroleum Processing* 4, 401-402, 405-407 (1949) *April.*

A set of detailed calculations are presented for the problem of expanding an existing absorption plant by means of refrigeration and deethanization, in order to produce commercial propane and butane. Possible propane recovery and refrigeration load are calculated for a given

set of conditions.

J. D. Parent

Stormont, D. H. CARTHAGE FIELDS SCENE OF HUGE GASOLINE-PLANT EXPANSION. *Oil Gas J.* **47**, 134-135, 229, 232-233 (1949) *April* 21.

Construction and enlargement of natural gasoline plants now under way in the Carthage field of east Texas will add some 600,000 Mcf of new plant capacity by mid-year, bringing the total capacity of the field's six plants to 1,030,000 Mcf daily. The new plant of the Carthage Corporation will process 385,000 Mcf. The United Gas Pipe Line Company is enlarging its plant from 100,000 to 210,000 Mcf and Chicago Corporation is enlarging its plant from 125,000 to 210,000 Mcf. For the field as a whole, gas recycling is not considered as feasible and most of the gas processed is discharged into gas transmission lines. It is estimated that approximately 6½ trillion cu ft of gas are in place in this field.

O. T. Bloomer

Petrochemicals

Bland, W. F. PETROCHEMICALS IN THE SOUTHWEST. *Petroleum Processing* **4**, 365-369 (1949) *April.*

The petrochemical industry in the Southwest is dominated by non-petroleum companies. Although there is no shortage of raw materials, costs have risen and cheap fuel gas (3 to 6¢/Mcf) is becoming difficult to obtain. Ethylene glycol and formaldehyde are the most important of the petrochemicals. Since formaldehyde is not stable above 37% concentration in aqueous solution, considerable water (63%) must be shipped with this chemical. Celanese is the first to use a specially designed tanker to ship formaldehyde.

C. H. Riesz

Bludworth, J. E. FIRST TONNAGE OXYGEN PLANT TIES IN WITH PETROCHEMICAL MANUFACTURE. *Petroleum Processing* **4**, 377-379 (1949) *April.*

The "tonnage" oxygen plant designed and built by Stacey-Dresser Engineering for the McCarthy Chemical Company at Winnie, Texas, is described. The plant produces 175 tons per day of 95% oxygen. Among the unusual features of the plant are the use of new aluminum alloys and Santocel and Fiberglas insulation for low temperature portions of the plant.

C. H. Riesz

Pipe Lines

Clay, J. A., Jr. INSULATION OF PIPE FITTINGS WITH PLASTICS. *World Oil* **128**, 157-158, 160 (1949) *April.*

The corrosion of pipe lines and casings caused by stray currents can be minimized by the use of insulating pipe fittings to isolate sections of the line. Plastic fittings such as plastic nipples, bushings and insulating couplings are considered for low pressure services. Flange insulation for high pressure service is discussed.

B. E. Hunt

Cunningham, L. J. SPACING IN PIPE LINE WELDING. *Oil Gas J.* **47**, 90 (1949) *April* 28.

Welding techniques used by Northern Natural Gas Company are outlined in detail. This company has had no service interruptions due to weld failure in the last ten years. Optimum spacing before tacking width of rod for stringer and filler beads and overlap of weld metal on the pipe are included in the discussion.

J. D. Parent

Geiger, F. G. EXPLOSION-PROOF MOTORS IN PIPE LINE OPERATIONS. *World Oil* **128**, 195-196, 198 (1949) *April.*

The development of the explosion-proof electric motor is briefly reviewed and its applicability to pumping high volatile liquids are discussed. Several modifications to meet unusual operating conditions are discussed.

O. T. Bloomer

Perkins, C. L. EL PASO'S TEXAS-CALIFORNIA LINE-SECOND STAGE OF CONSTRUCTION. *Petroleum Engr.* **21D**, 37-38, 43-46, 48 (1949) *March.*

Details of work completed during 1948 on the Texas-California El Paso Line are presented.

J. D. Parent

Sherer, L. F. and Mudd, O. C. MECHANICAL ASPECTS OF PIPE-LINE COATINGS. *Oil Gas J.* **47**, 119-122 (1949) *March* 31.

The most economical method of protecting buried pipe is to apply a coating which will remain stable under soil pressure and which has a low rate of water absorption and then apply cathodic protection to compensate for any imperfections. The most important improvements in coating applications are those resulting from increased mechanization and increased carefulness in burying the coated pipe. Of primary importance in the application of coatings is the preliminary treatment of the pipe surface.

B. E. Hunt

Production

Arps, J. J. and Smith, A. E. PRACTICAL USE OF BOTTOM-HOLE-PRESSURE BUILDUP CURVES. *Oil Gas J.* **47**, 91-92, 128, 130 (1949) *April* 28.

Considerable time may be required to measure the static bottom hole pressure of a well if the well is shut in until pressure equilibrium is established. Unless the productivity index is high it may not be feasible to wait for equilibrium. Measurements over a period of several hours or even less may be treated mathematically so that the ultimate value may be calculated. A method proposed by Muskat is reviewed and a new one is suggested.

J. D. Parent

Carlougher, R. C. and Robinson, J. M. PREDICTION OF SECONDARY RECOVERY FROM CORE ANALYSIS. *Oil Gas J.* **47**, 111-113, 116 (1949) *March* 31.

Information desired from core analysis includes: (1) net sand thickness; (2) oil content; (3) porosity; (4) water content; and (5) permeability. Laboratory flooding tests may be performed to study the displacement of oil by water and so aid in the prediction of secondary recovery efficiency.

J. D. Parent

Edinger, W. M. INTERPRETATION OF CORE ANALYSIS RESULTS. *Oil Gas J.* **47**, 104, 108-110 (1949) *March* 31.

Coring with water base mud does not permit accurate determination of connate water. Oil or oil base muds leave the connate water intact. Some useful applications are discussed. Among these are the possibility of early recognition of a watered out condition.

J. D. Parent

Guyod, H. RESISTIVITY METHOD DISCOVER OIL DIRECTLY? PART I. THEORETICAL DEPTH-RESISTIVITY CURVES. *World Oil* **128**, 69-70 (1949) *April.*

The resistivity method for oil and gas exploration is theoretically attractive, but has been very disappointing in practice. Important complicating factors have been neglected. These factors will be explained in a subsequent installment.

J. D. Parent

Hock, R. L. PERFORMANCE AND EFFICIENCIES OF A GAS CYCLING OPERATION. *Oil Gas J.* **47**, 140-141, 235-236, 240 (1949) *April* 21.

Experiences and the cycling program in the Cotton Valley field during eight years of operation are recounted.

J. D. Parent

Jones, E. N. ACIDIZING TECHNIQUES IN SAND FORMATIONS. *World Oil* **128**, 168, 170, 172, 174 (1949) *April.*

This is the first of a two part article on acidizing techniques in sand formations. The purpose of acidizing is to remove the soluble binder between the quartz grains so as to provide augmented flow channels in the vicinity of the bore hole. The techniques to be used are determined with the aid of complete well information and differ for each well. The methods selected and results obtained on acidizing several wells are included.

O. T. Bloomer

Muskat, M. SUMMARIZATION STATEMENT ON GAS INJECTION. *Oil Gas J.* **47**, 89-90 (1949) *March* 31.

The basic nature of gas injection operations is considered to be well understood. A basic advance has been made in recent years in the mathematical treatment by including a material balance. The change of oil to gas ratio during operation has previously been difficult to evaluate, but the permeability-saturation characteristics of reservoir rocks have been found to control this factor. Unfortunately, it is necessary to make assumptions regarding the distribution and disposition of injected gas. Complete commingling with previously developed free gas or complete segregation is assumed. Each reservoir must be studied specifically as injection is not helpful in some cases and may hinder in others, while being of considerable value in many instances.

J. D. Parent

Townsend, A. A. APPLICATIONS OF SURFACE PLUGGING AGENTS IN OIL AND GAS WELLS. *World Oil* **128**, 124, 126, 127 (1949) *April.*

Surface plugging agents are used in drilling to hinder or prevent the flow of mud into permeable formations. The action is mechanical clogging except where a setting material such as cement or plastic is used. Stage wise application is practiced.

J. D. Parent

Reserves

Brownscombe, E. R. and Collins, F. ESTIMATION OF RESERVES AND WATER DRIVE FROM PRESSURE AND PRODUCTION HISTORY. *J. Petroleum Technol.* **1**, *Trans. Sect.* 92-99 (1949) *April.*

The problem of simultaneously estimating the quantity of hydrocarbons in place in a reservoir and the strength of the water drive in a pool is treated. Accurate reservoir pressure data are required for the proposed analysis.

J. D. Parent

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Dormer, G. G. PEAK LOAD EXPERIENCES. p. 103

Krause, A. W. and Cunningham, A. M. INTERCHANGEABILITY OF OIL GASES. p. 102

Kulman, F. E. CORROSION CONTROL OF HIGH PRESSURE GAS DISTRIBUTION SYSTEM. p. 102

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Catalytic Cracking

Drake, L. C. PORE-SIZE DISTRIBUTION IN POROUS MATERIALS. APPLICATION OF HIGH PRESSURE MERCURY POROSIMETER TO CRACKING CATALYSTS. *Ind. Eng. Chem.* **41**, 780-785 (1949) *April.*

A high pressure mercury porosimeter has been applied to cracking catalysts to determine pore size distribution. The method is based on the principle [Washburn, *Proc. Natl. Acad. Sci.* **7**, 115 (1921)] that for a constant surface tension and contact angle the diameter of a pore enterable by mercury is inversely proportional to the pressure applied. The equipment described permits measurements over the range of 25 to 60,000 psi (85,000 to 35 Angstrom) pore openings. Three types of commercial catalytic cracking catalysts were investigated. Fresh catalysts contained many pores smaller than 35 Angstroms; aging either artificially or in service closed the smaller pores and increased the quantity of medium sized (50 to 100 Angstrom) pores. Carbon from gas oil cracking was deposited uniformly throughout the pore-size range studied.

C. H. Riesz

Hornaday, G. F., Noll, H. D., Peavy, C. C. and Weinrich, W. VARIOUS REFINERY APPLICATIONS OF HOUDRIFLOW CATALYTIC CRACKING. *Oil Gas J.* **47**, 90-94 (1949) *April* 7.

Five processing arrangements using Houdriflow catalytic cracking are compared with thermal cracking. It is concluded that coking or visbreaking are the best methods for preparing

catalytic charging stocks and that catalytic cracking is advantageous in minimizing the production of residual fuel.

C. H. Riesz

Nelson, E. F. PLATFORMING IMPROVES MOTOR FUELS. *Petroleum Engr.* **21C**, 22-24, 26, 29-30 (1949) *April.*

Hydroforming in the presence of platinum catalysts has been announced and termed "platforming" by the Universal Oil Products Company. The plant is simple and its initial investment costs are comparable to thermal reforming plus polymerization. High yields of high octane product are desirable features of the process. Other recent advances in petroleum technology are considered briefly. Precipitate formation in fuel oils is attributed to the presence of either disulfides from sweetening or of sodium salts of organic acids from caustic washing. The development of fluid catalytic cracking processes by Universal Oil Products Company is reviewed briefly. The three fundamental types of cracking catalyst are: (1) natural; (2) synthetic silica-alumina; and (3) synthetic silica-magnesia. Small concentrations of thiophenols and other acid oils in catalytic gasolines are extremely detrimental to storage stability but are easily removed by a caustic wash.

C. H. Riesz

Shand, E. W. (Assigned to Sinclair Refining Co.) PYROLYTIC CONVERSION OF HYDROCARBONS. U.S. 2,464,266 (1949) March 15.

Cracking catalyst is dispersed in oil to be charged to a fluid catalyst process by grinding (colloid mill) in the presence of a wetting agent (e.g., 0.01 to 0.05% lecithin). The grinding is done under super-atmospheric pressure and the oil-catalyst mixture is preheated and flashed in a flash chamber before passing to the reactor.

C. H. Riesz

Pipe Lines

Cahill, J. L. ENGINEERING ECONOMICS AND HISTORY OF PIPE LINES. *World Oil* 128, 200, 202, 204, 206 (1949) *April.*

The economics of oil pipe lines are reviewed briefly.

J. D. Parent

Production

Calhoun, J. C., Jr. ENGINEERING FUNDAMENTALS. BEAL'S CORRELATION OF RESERVOIR OIL VISCOSITY. *Oil Gas J.* **47**, 139 (1949) *April* 28.

Oil viscosity varies linearly with pressure above saturation pressure. Oil gravity and temperature and pressure of the reservoir are the variables required for estimation of oil viscosity. Dissolved gas is a very important factor, and this is correlated with pressure.

J. D. Parent

Muskat, M. SUMMARIZATION STATEMENT ON PARTIAL WATER DRIVES. VI. *Oil Gas J.* **47**, 87-88 (1949) *April* 7.

The manner of evaluating partial water drive is briefly discussed. Most oil producing reservoirs are of this type.

J. D. Parent

Synthetic Liquid Fuels

Beck, R. A., Sensel, E. E. and Millendorff, A. J. (Assigned to Texas Co.) HYDROCARBON SYNTHESIS. U.S. 2,464,480 (1949) March 15.

A high level of conversion of carbon monoxide and hydrogen into liquid hydrocarbons may be maintained by incorporating an alkali metal compound into the catalyst and elevating the reaction temperature as catalytic activity declines. A catalyst such as cobalt-thoria-magnesia on Filter Cel may or may not contain alkali originally but, in any case, the alkali content should not exceed 3% by weight of the metallic cobalt.

C. H. Riesz

Grahame, J. H. (Assigned to Texas Co.) CATALYTIC SYNTHESIS OF HYDROCARBONS. U.S. 2,464,501 (1949) March 15.

In conjunction with the synthesis of liquid hydrocarbons from the catalytic interaction of carbon monoxide and hydrogen, the partial combustion of natural gas with oxygen is used

to form synthesis gas. Heat from this process is recovered by a bed of fluidized catalyst. The heated catalyst is used in processing low-octane synthesis liquid.

C. H. Riesz

Sellers, F. B. (Assigned to Texaco Development Co., Inc.) CATALYTIC SYNTHESIS OF HYDROCARBONS. U.S. 2,464,532 (1949) March 15.

In conjunction with the catalytic synthesis of liquid hydrocarbons from carbon monoxide and hydrogen, partial combustion of natural gas with oxygen forms synthesis gas. The sensible heat of the products from this reaction is recovered by a bed of fluidized cracking catalyst which is used to (1) process low-octane synthesis liquid, (2) superheat steam, and (3) provide for the interaction of steam and carbon laid down in the hydrocarbon cracking operations.

C. H. Riesz

Storch, H. H. and Hirst, L. L. (Assigned to U.S.A.) COAL LIQUEFACTION BY HYDROGENATION. U.S. 2,464,271 (1949) March 15.

Coal is hydrogenated into fuel oil in a two-step process. In the first step, powdered coal is pasted with one to two parts of heavy recycle oil and between 0.004 and 0.006 parts of a tin sulfide and iodide mixture (equal parts by weight of each); the entire mixture is converted at 880 to 1030 lbs per sq in. with inlet temperatures of 700 to 725°F, exit temperatures of 750 to 780°F. In the second step, the product from the above step passes through a second converter containing bright stainless steel turnings with inlet temperatures of 770 to 790°F and exit temperatures of 805 to 825°F.

C. H. Riesz

Tanks

Murray, H. D. SELECTION AND MAINTENANCE OF TANKS IN SULFIDE AREAS. *World Oil* 128, 161-162, 164, 166 (1949) *April.*

The considerations involved in selecting tanks for crude oil service are as follows: production rates, conservation of light ends, corrosion resistance, salvage value, latest design features, and cost. The use of aluminum for roofs of tanks, and the use of cone bottoms on tanks has received wide acceptance. Galvanize, asphalt and plastics have been used for coatings. The advent of synthetic rubber has increased the service life of rubber gaskets used on bolted tanks. Maintenance of tanks includes application and repair of coatings on the inside and outside of tanks. A table is presented comparing wooden, bolted steel, and shop welded steel tanks, and the greatest number of advantages are found in bolted steel tanks.

W. J. Merwin

The following article, which has not been abstracted, is called to your attention:

COST-IMATING PIPE STILLS. *Oil Gas J.* 47, 109 (1949) *April* 7.

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Edinger, W. M. INTERPRETATION OF CORE ANALYSIS RESULTS. p. 107

Edmister, W. C. APPLICATIONS OF THERMODYNAMICS TO HYDROCARBON PROCESSING. p. 114

Guyod, H. RESISTIVITY METHODS DISCOVER OIL DIRECTLY? p. 107

Kobe, K. A. and Long, E. G. THERMOCHEMISTRY FOR THE PETROCHEMICAL INDUSTRY. p. 115

Muskat, M. SUMMARIZATION STATEMENT ON GAS INJECTION. p. 108

Townsend, A. A. APPLICATION OF SURFACE PLUGGING AGENTS IN OIL AND GAS WELLS. p. 108

7. ANALYTICAL METHODS AND TESTS

Calorimeter

Rice, R. B. SIMPLE CALORIMETER FOR SPECIFIC HEAT MEASUREMENTS. *ASTM Bull.* **1949**, 72-75 (March).

The construction and operation of an inexpensive apparatus for the quantitative estimation of the specific heat of powdered solids is described. The operation of this calorimeter depends upon determining the total heat capacity of the calorimeter plus the powdered sample suspended in a contact liquid, and subtracting from this value the calorimeter constant and heat capacity of the contact liquid. This is accomplished by measuring the heat input in terms of electrical energy required to produce a measured increase in temperature of the system. It is claimed that one determination can be made in twenty minutes and that the accuracy of results is approximately 1%. The apparatus may be adapted to the measurement of the heat capacity of liquids.

H. Hakewill

Carbon Monoxide Detection

CARBON MONOXIDE POISONING PREVENTED BY NEW CHEMICAL. *Can. Chem. & Process Ind.* **33**, 321 (1949) *April.*

The use of silver permanganate to detect and remove carbon monoxide from the air is proposed. It is alleged to be far more effective than hopcalite. It is more easily stored, has a longer life and is sensitive to very low concentrations of the toxic gas.

S. Katz

Micro Analysis

Mendoza, M. P. MICROCHEMICAL ANALYSIS. *Bull. Brit. Coal Utilization Research Assoc.* **13**, 1-8 (1949) *January.*

This article consists of brief discussions reviewing the microchemical balance, organic and inorganic micro-chemical analysis, micro gas analysis, and micro analysis of coals and cokes. There are 64 references cited to supplement the descriptions of apparatus and procedures given.

H. Hakewill

Oxygen Detection

GRAVITY BALANCE DETECTS OXYGEN IN GAS STREAM. *Gas* **25**, 39 (1949) *April.*

An apparatus designed to detect the presence of air in a gas stream and to actuate a mechanism to close a valve to stop the gas flow is described. It is essentially an Ac-Me gravity balance in which an additional view lens has been mounted on each side of the cylinder. When air gets into the gas stream, the heavier specific gravity is detected by the gravity balance, the balance arm moves to cut the light beam of a photoelectric circuit, and an electronic relay activates an electrically operated solenoid valve to effectively prevent the movement of oxygen through the pipeline system. A unit of this type has been in service for nearly a year and has operated very satisfactorily and without requiring adjustment during this period.

H. Hakewill

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Bainbridge, J. R., Scanlan, P. G. and Belyea, I. DETERMINATION OF MOISTURE IN BROWN COALS BY DISTRIBUTION. p. 102

Grosse, A. V., Hindin, S. G. and Kirshenbaum, A. D. ELEMENTARY ISOTOPIC ANALYSIS. p. 113

8. GENERAL AND PHYSICAL CHEMISTRY

Activated Charcoal

Wiig, E. O. and Juhola, A. J. THE ABSORPTION OF WATER VAPOR ON ACTIVATED CHARCOAL. *J. Am. Chem. Soc.* **71**, 561-568 (1949) *February.*

It is shown that charcoal granules exposed to water vapor undergo an initial contraction, followed by expansion as the water vapor pressure is increased. A semi-empirical relation based on theories of capillary condensation is proposed. The density of the adsorbed water was found to be slightly less than unity.

S. Katz

Sheffer, H., Waldock, K. T. and Ferguson, J. B. THE TESTING OF ACTIVATED CHARCOALS BY THE ISOPIESTIC METHOD. *Can. J. Research* **27B**, 25-34 (1949) *January.*

An isopiestic method of comparing activities of activated charcoals is described. A comparison of variations of the procedure is described, and tests with the vapors of various liquids are described.

S. Katz

Equilibria

Hough, E. W. and Sage, B. H. VOLUMETRIC BEHAVIOR IN SEVERAL GASEOUS HYDROCARBON SOLUTIONS. *Chem. Revs.* **44**, 193-204 (1949) *February.*

Molal volumes of binary mixtures of methane, ethane, propane, and n-butane are measured experimentally, and are compared with the equation of state proposed by Benedict. As shown by tables, they are found to agree within the experimental range which is from 1 to 204 atmospheres pressure and 38 to 121° Centigrade temperature. At low pressures and high temperatures ideal solution assumption is adequate for methane-ethane mixtures.

S. Mori

Wenner, R. R. PREDICTION OF REACTION EQUILIBRIA. *Chem. Eng. Progress* **45**, 194-207 (1949) *March.*

This paper describes methods of determining reaction equilibrium, with a consideration of sources of data and methods of making the calculations. The equilibrium constant is derived from the free energy change which, in turn, is defined as a function of enthalpy and entropy changes. Methods of estimating the former are considered, including the use of heats of formation and summation of bond energies, or auxiliary thermodynamic relations. Entropies are determined from molecular spectra and various empirical relations. In addition, auxiliary methods, such as the successive integration of heat capacity data to determine free energies are described. Illustrative applications include the determination of the equilibrium constants of the formation of aldehyde from ethane, CO and H_2 (the OXO process), nitric acid synthesis from NO_2 and H_2O, synthesis of long chain alcohols by hydration of olefins and carbon-oxygen equilibria in liquid iron.

S. Katz

Evering, B. L. and D'Ouville, E. L. EXPERIMENTAL EQUILIBRIUM CONSTANTS FOR THE ISOMERIC HEXANES. *J. Am. Chem. Soc.* **71**, 440-445 (1949) *February.*

Experimental data for equilibria of isomeric hexanes, at temperatures from 21 to 204 degrees Centigrade, were obtained from a 67° light naphtha feed and aluminum chloride catalyst. Included in the article are tables containing the equilibria composition. Using the data from this table and also vapor pressure and fugacity data in the literature, a vapor-liquid equilibria composition was also calculated. Finally tables comparing ΔF, T, entropy, and heat of reaction obtained experimentally with previous works are presented.

S. Mori

Gas Solubilities

Morrison, T. J. and Billett, F. THE MEASUREMENT OF GAS SOLUBILITIES. *J. Chem. Soc.* (British) **1948**, 2033-2035 (December).
A simple method for measuring gas solubilities in various solvents is described. The accuracy is at least equal to the Ostwald method, and at the same time it does away with errors due to supersaturation or changes in the volume due to gas absorption in the solvent.

S. Mori

Isotopic Analysis

Grosse, A. V., Hindin, S. G. and Kirshenbaum, A. D. ELEMENTARY ISOTOPIC ANALYSIS. DETERMINATION OF OXYGEN, CARBON, AND NITROGEN IN ORGANIC COMPOUNDS. *Anal. Chem.* **21**, 386-390 (1949) *March.*

In isotopic analysis, the unknown compound of known weight is mixed with a known amount of the appropriate isotope and the mixture is brought to equilibrium. The concentration of the unknown is then determined from a mass spectrometer analysis which gives the ratio of the unknown to the isotope. Details of methods of measuring oxygen, nitrogen and carbon are given.

S. Katz

Radio-chemistry

Borkowski, C. J. INSTRUMENTS FOR MEASURING RADIOACTIVITY. *Anal. Chem.* **21**, 348-352 (1949) *March.*

The Geiger Muller counter, beta proportional counter, and the high pressure gamma chamber are used presently for measuring the radioactivity in tracer studies. The first is most widely used because of its simplicity, sensitivity and availability, but for low intensity beta emission the proportional counter is more accurate. The gamma radiating isotopes are measured in the high pressure gamma chamber because of the simplicity in preparation of the samples.

S. Mori

Kohman, T. P. MEASUREMENT TECHNIQUES OF APPLIED RADIOCHEMISTRY. *Anal. Chem.* **21**, 352-364 (1949) *March.*

Techniques of sample preparation, and methods of reducing errors in sampling, environmental variation, and instrumental measurements in the field of radiochemistry are presented. By careful elimination of these errors, radiochemistry can be shown to be a valuable analytical tool in obtaining relative as well as absolute measurements. Application to gas samples is also discussed. Statistical methods also can be used advantageously in reducing errors.

S. Mori

Radiochemistry Symposium

In recent years the increasing availability of radioisotopes has had a profound influence on many of the techniques of organic and physical chemistry. Of interest in the gas industry are the radioactive halogens, radioactive sulfur, S^{35}, and, especially, radioactive carbon, C^{14}. The use of these substances as tracers in problems of structural analysis, reaction mechanisms, etc., will play a part of constantly increasing magnitude in the development of chemistry and chemical technology. This symposium, dealing as it does with the laboratory facilities and disciplines necessary for the safe handling of these materials is therefore especially timely.

S. Katz

Tompkins, P. C. and Levy, H. A. IMPACT OF RADIOACTIVITY ON CHEMICAL LABORATORY TECHNIQUES. *Ind. Eng. Chem.* **41**, 228-231 (1949) *February.*

Radiation hazards are of two classes, contamination due to the migration of radioactive materials into undesirable locations, and exposure to radiation. The effect of these factors on the design of experimental methods is discussed, and a classification of both hazards into levels of safety is given.

S. Katz

Swartout, J. A. RESEARCH WITH LOW LEVELS OF RADIOACTIVITY. *Ind. Eng. Chem.* **41**, 233-236 (1949) *February.*

The design proposed follows those for conven-

tional laboratories with special reference to hood design for the elimination of radioactive gases and dusts, and the selection of materials for laboratory construction which lend themselves to effective decontamination.

S. Katz

Levy, H. A. REMODELING A LABORATORY FOR RADIOCHEMICAL INSTRUCTION OR RESEARCH. *Ind. Eng. Chem.* **41**, 248-250 (1949) *February.*

The adaptation of a laboratory for radiation work is feasible where low energy activity will be encountered. The arrangement of working space is described, and the handling of high activity materials for short intervals is indicated. Waste disposal and monitoring of personnel and installations are discussed briefly.

S. Katz

Thermal Decomposition

Partington, R. G. and Danby, C. J. THE THERMAL DECOMPOSITION OF n-HEXANE. *J. Chem. Soc.* (British) **1948**, 2226-2232 (December).

The thermal decomposition of n-hexane was studied in the 500-600°C temperature range. The reaction is of first order except at the lower pressures. The nitric oxide inhibited reaction is of fractional order. A decomposition mechanism is proposed.

S. Katz

Szwarc, M. THE KINETICS OF THE THERMAL DECOMPOSITION OF PROPYLENE. *J. Chem. Phys.* **17**, 284-291 (1949) *March.*

Two alternative mechanisms for the thermal decomposition of propylene are proposed from the experimental results which show the decomposition reaction to be homogeneous, first order; the products of combustion are H_2, CH_4 and allene. They are also found to obey Arrhenius' law, from which the energy of activation and the frequency factor are obtained. Both mechanisms depend upon the formation of an allyl free radical and H atom for their initiating reaction.

S. Mori

Szwarc, M. THE KINETICS OF THE THERMAL DECOMPOSITION OF ISOBUTENE. *J. Chem. Phys.* **17**, 292-295 (1949) *March.*

Experimental results show that the thermal decomposition of isobutene is homogeneus, first order, and obeys Arrhenius' law. From these results and the product of decomposition, the mechanism of the reaction is proposed. The mechanism is discussed from the standpoint of energy of activation and frequency factor.

S. Mori

Thermodynamics

Beattie, J. A. THE COMPUTATION OF THE THERMODYNAMIC PROPERTIES OF REAL GASES AND MIXTURES OF REAL GASES. *Chem. Revs.* **44**, 141-192 (1949) *February.*

Thermodynamic properties of gas mixtures may be obtained from data of their pure component gases by using the Gibbs-Dalton, Lewis-Randall, or the general limit method together with combination of constants in an equation of state. The first two methods give approximate results while the last gives the most accurate representation of the properties of mixed gases. Each method is carefully developed from its basic equation to the point where it may be applied to real gaseous mixtures. Also included are all assumptions and conditions required for each of the methods.

S. Mori

Edmister, W. C. APPLICATIONS OF THERMODYNAMICS TO HYDROCARBON PROCESSING. PART XVII - ENTHALPY - ENTROPY PLOTS FOR PURE HYDROCARBONS. *Petroleum Refiner* **28**, 139-150 (1949) *March.*

The construction of Mollier diagrams is described in this paper. Reference is made to the variety of datum points used in different compilations, and the advantages of using the ideal gas state at —459.7°F are presented. Two methods are described for the cases where considerable precise data are available, and where limited data of doubtful accuracy are to be used. Both methods are set forth in series of

operations. The rigorous method correlates the available data to construct charts which are combined to form the Mollier diagram. The approximate method estimates the volumes, entropies, enthalpies, etc., from generalized correlations. The recent data of Rossini et al. of the Bureau of Standards are recommended for hydrocarbons, especially their temperature - entropy - enthalpy compilations. The paper concludes with illustrations of a number of hydrocarbon Mollier charts including a well-known series by the author which he regards as obsolete.

S. Katz

Kobe, K. A. and Long, E. G. THERMOCHEMISTRY FOR THE PETROCHEMICAL INDUSTRY. PART III. MONOOLEFINIC HYDROCARBONS, C_2, C_4. *Petroleum Refiner* 28, 125-128 (1949) *March.*

The specific heat and enthalpy data for a few of the lower molecular monoolefinic hydrocarbons between 0° and 1200°C range are given in Centigrade, Fahrenheit, Kelvin, and Rankin scales, with references to their sources. A table containing free energy, heat of formation, and heat of combustion at 25°C, and another containing constants for the heat capacity equation for these olefins are included in this article.

S. Mori

Redlich, O. and Kister, A. T. ON THE THERMODYNAMICS OF SOLUTIONS. IV. THE DETERMINATIONS OF LIQUID - VAPOR EQUILIBRIA BY MEASURING THE TOTAL PRESSURE. *J. Am. Chem. Soc.* 71, 505-507 (1949) *February.*

The liquid composition for a binary mixture having similar boiling points may be calculated from the total vapor pressure of the mixture by the use of a differential manometer between the mixture and one of the pure components at approximately the same temperature, and by keeping the vapor space above the mixture as small as possible. The method of calculation is discussed in detail.

S. Mori

Redlich, O. and Kwong, J. N. S. ON THE THERMODYNAMIC FUGACITIES OF GASEOUS SOLUTIONS. *Chem. Revs.* 44, 233-244 (1949) *February.*

An equation of state is proposed which shows better agreement with experimental data over a wider pressure range than the equations of state obeying the corresponding state theorem. From this equation an algebraic expression for fugacity is obtained. The two equations are extended to gas mixtures where the fugacities of the individual components are made obtainable. A simple approximate method for obtaining fugacities in mixtures is also presented.

S. Mori

Waddington, G., Knowlton, J. W., Scott, D. W., Oliver, G. D., Todd, S. S., Hubbard, W. N., Smith, J. C. and Huffman, H. M. THERMODYNAMIC PROPERTIES OF THIOPHENE. *J. Am. Chem. Soc.* 71, 797-808 (1949) March.

Measurements of the heat capacity over the temperature range 11-340°K, vapor pressure over the temperature range of 0 to 120°C, heat of vaporization at three different temperatures, heat of combustion, heat capacity of the vapor at five different temperatures over the range 343 to 472°K, and the entropy of liquid thiophene were made. On the basis of spectroscopic data a complete vibrational assignment was proposed for thiophene. Using this vibrational assignment and other molecular structure data, values of the free energy function, heat-content function, entropy, and heat capacity were calculated by the methods of statistical mechanics for various temperatures up to 1500°K.

H. Hakewill

Transport Properties

Hirschfelder, J. O., Bird, R. B. and Spotz, E. L. THE TRANSPORT PROPERTIES OF GASES AND GASEOUS MIXTURES. II. *Chem. Revs.* 44, 205-231 (1949) *February.*

Intermolecular force constants are determined from experimental measurements of certain transport properties. Other transport properties, as a function of temperatures, are calculated from these constants. The calculation is

extended to mixtures. Of interest is a table of calculated viscosities for flue gas at various temperatures and compositions. These values are compared with viscosities obtained experimentally.

S. Mori

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Badin, E. J., Stuart, J. G. and Pease, R. N. BURNING VELOCITIES OF BUTADIENE—1,3 WITH NITROGEN-OXYGEN AND HELIUM OXYGEN MIXTURES. p. 98

Kinney, C. R. and Spliethoff, W. L. A SYSTEM CORRELATING MOLECULAR STRUCTURE OF ORGANIC COMPOUNDS WITH THEIR BOILING POINTS. p. 116

Pourbaix, M. CORROSION, PASSIVITY AND PASSIVATION FROM THE THERMODYNAMICS POINT OF VIEW. p. 120

9. ORGANIC CHEMISTRY

Molecular Structure

Kinney, C. R. and Spliethoff, W. L. A SYSTEM CORRELATING MOLECULAR STRUCTURE OF ORGANIC COMPOUNDS WITH THEIR BOILING POINTS. VII. NEW BOILING POINTS FOR CERTAIN PARAFFINS AND OLEFINS. *J. Organic Chem.* **14**, 71-78 (1949) *January.*

The boiling points of 10 paraffins and 12 olefins not in agreement with values calculated from a system based on molecular structure [Kinney, *J. Am. Chem. Soc.*, **60**, 3032 (1938)] have been reexamined. A structural factor for 3,3 dialkyl paraffin hydrocarbons and a new structural value for tetrasubstituted olefins provides good agreement between observed and calculated values.

C. H. Riesz

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Partington, R. G. and Danby, C. J. THE THERMAL DECOMPOSITION OF n-HEXANE. p. 114

Szwarc, M. THE KINETICS OF THE THERMAL DECOMPOSITION OF PROPYLENE. p. 114

Szwarc, M. THE KINETICS OF THE THERMAL DECOMPOSITION OF ISOBUTENE. p. 114

10. CHEMICAL ENGINEERING

Absorption

Edmister, W. C. HYDROCARBON ABSORPTION AND FRACTIONATION PROCESS DESIGN METHODS. PART XX. (CONCLUSION) DESIGN PROCEDURES. *Petroleum Engr.* **21C**, 13-14, 16, 18, 20-21 (1949) *March.*

A complete design for a multicomponent fractional distillation system involves not merely tray-to-tray component distribution calculations but also (a) preliminary component distribution estimation and lay-out of flow sheets, (b) establishing tower pressures and temperatures of reflux and reboiled vapors, (c) heat balances for establishing heat exchange requirements, (d) establishing recycle streams, (e) application of pilot plant data to design, and (f) calculation of thermodynamic efficiency of process to see if improvements can be made.

J. D. Parent

Hutchings, L. E., Stutzman, L. F. and Koch, H. A., Jr. GAS ABSORPTION. *Chem. Eng. Progress* **45**, 253-268 (1949) *April.*

The authors have studied the effect of liquid rate, gas rate, and packing diameter for the system acetone-air-water at atmospheric pressure and room temperature. $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, and $1\frac{1}{4}$ in. Raschig rings and 4, 6, and 10 in. columns were used in the study. Gas film coefficients were correlated as a function of packing diameter, liquid mass velocity, and gas mass velocity. For possible extension to other types of packing, the correlation of Brownell and Katz, (*Chem. Eng. Progress* **43**, 10, 537-548; **43**, 11, 601-612) was applied in replacing the diameter function with a function of wetted porosity and wetted

sphericity. The liquid film coefficient was found to be a function solely of liquid mass velocity.

C. L. Tsaros

Cooling Towers

Pfeiffer, E. L. WHAT SIZE COOLING TOWERS? *Chem. Eng.* **56**, 99-100 (1949) *April.*

By means of charts and factors presented by the author, it is possible to make preliminary estimates of cooling towers. The items estimated are the ground area, the fan power, the pump power, and the make-up water requirements.

W. J. Merwin

Diffusion Coefficients

Wilke, C. R. ESTIMATION OF LIQUID DIFFUSION COEFFICIENTS. *Chem. Eng. Progress* **45**, 218-224 (1949) *March.*

A method is presented for estimating liquid diffusion coefficients, based on the Stokes-Einstein equation and the Eyring theory of reaction rates applied to diffusion. The latter considers diffusion to involve viscous flow of the solute molecule through holes in the solvent, a certain activation energy being required for hole formation. For convenience, the diffusion factor, $F = T/D\mu$, where T = absolute temperature, D = diffusion coefficients, μ = viscosity, is plotted versus solute molal volume at constant solvent factor ϕ. This factor, at low molal volumes is the ratio of F for diffusion in a given solvent to the F for diffusion in water at the same molal volume. At higher molal volumes the factors approach that of water. This method is reasonably satisfactory for the estimation of liquid coefficients in dilute solutions. Observed data for diffusion coefficients from 178 experiments have been reproduced by the method with an average deviation of 10%.

C. L. Tsaros

Flow

FLOW RESEARCH YIELDS NEW DATA ON VALVE PRESSURE — DROP CHARACTERISTICS. *Power* **93**, 106-107 (1949) *May.*

Flow pattern studies leading to more efficient valve design are reported.

J. D. Parent

Fluid Flow

Calhoun, J. C., Jr. ENGINEERING FUNDAMENTALS. ANALOGY BETWEEN ELECTRICAL AND FLUID FLOW. *Oil Gas J.* **47**, 301 (1949) *March* 24.

Correspondence between electrical and fluid flow is general. The analogy between Darcy's and Ohm's laws is pointed out. It is shown that viscosity divided by permeability in fluid flow is analogous to specific resistivity in electrical flow. Whereas it is unnecessary to break the latter down, it is necessary to do so for fluid flow as the viscosity is a characteristic of the fluid and the permeability is a characteristic of the rock system.

J. D. Parent

Long, E. EQUATION FOR OPTIMUM PIPE SIZE WITH VISCOUS FLOW. *World Oil* **128**, 197-198 (1949) *April.*

Primary concern of this article is the relation of optimum pipe size and viscosity for flow of petroleum under viscous or laminar flow conditions.

J. D. Parent

Heat and Mass Transfer

McAdams, W. H., Pohlenz, J. B. and St. John, R. C. TRANSFER OF HEAT AND MASS BETWEEN AIR AND WATER IN A PACKED TOWER. *Chem. Eng. Progress* **45**, 241-252 (1949) *April.*

This article reports a study of film coefficients for simultaneous heat and mass transfer between air and water under adiabatic isothermal conditions. Runs were made in a tower packed with 1 in. carbon Raschig rings. The gas film heat transfer coefficient was correlated

as a function of gas mass velocity, liquid mass velocity, and film temperature. The assumption of constant ratio between h_{ga} and k_{ga} was not validated by the data. This assumption depends on two factors: (1) complete wetting of the particle surface; and (2) attainment of adiabatic saturation temperature on the surface. At higher gas rates, with better liquid distribution, the theoretical ratio (equal to the humid heat) was more closely approached. End effects were evaluated by running with bed heights of 6, 9 and 12 inches and were found to be equivalent to 7.2 inches. By making use of the above assumption of constant ratio, the heat transfer coefficient for the liquid was approximated as a function of both gas and liquid mass velocities.

C. L. Tsaros

Raber, B. F. and Hutchinson, F. W. TABULAR DETERMINATION OF THE OVERALL COEFFICIENT OF HEAT TRANSFER FOR PIPES AND TUBES. *Heating & Ventilating* **46**, 73-77 (1949) *March.*

This article succeeds sixteen others which were devoted to the graphical determination of film coefficients for sixteen different refrigerants. The authors give a series of tables for determining the overall coefficient, using the individual film coefficients, without the work of calculating such overall coefficients for cases in which the resistance of the tube wall is negligible. It is felt that the previous articles would be the most valuable of the series.

R. T. Ellington

Taecker, R. G. and Hougen, O. A. HEAT, MASS TRANSFER OF GAS FILM IN FLOW OF GASES THROUGH COMMERCIAL TOWER PACKINGS. *Chem. Eng. Progress* **45**, 188-193 (1949) *March.*

This investigation extends the j-factor plots published by Gamson, Thodos, and Hougen (*Trans. Am. Inst. Chem. Engrs.* **39**, 1 (1943), for solid spheres and cylinders. These factors were found, for a given system, to be a function of a modified Reynolds number. The present paper reports studies made with ½, 1, and 2 in. Raschig rings, 2 in. partition rings, and ¼ and ½ in. Berl saddles. The packing was fabricated from a clay-kieselguhr mixture of high porosity and capillarity so that the solid would be kept wetted during the constant-rate drying period when the evaporation rate was measured. Instead of using the particle diameter in the Reynolds number, the square root of the particle area was substituted. The same type of correlation was obtained as with spheres and cylinders. j values for rings fall about 19% below those for solids and cylinders, while those for Berl saddles are higher at the higher velocity range and lower at the low velocity range than those for spheres and cylinders. Values for the saddles averaged about 30% higher than those for the rings.

C. L. Tsaros

Orifice Calibration

Wingard, R. E. and Williamson, H. P., Jr. A METHOD FOR CALIBRATING A GAS ORIFICE. *J. Southeastern Research* **1**, 7-8 (1949) *April.*

A study was made of the gas dilution method for orifice calibration for rates of air flow ranging from 10 to 700 cu ft per hr employing pipe orifice plates of ¼ in., ½ in., and 1½ in. opening. To carry out the calibration weighed quantities of carbon dioxide were added to the air stream on the inlet side of the orifice and the percentage of CO_2 in the exit gas from the orifice was determined by Orsat analysis. Total gas volumes were calculated from the weight of CO_2 used and the percentage of CO_2 found in the mixture. It is claimed that calibrations made by this method were accurate to about 1%, and that calculated orifice coefficients were in substantial agreement with those given in the literature.

H. Hakewill

Pilot Plant

Gwin, G. T. and Yule, L. T. GENERAL PURPOSE PILOT PLANT. *Ind. Eng. Chem.* **41**, 862-867 (1949) *April.*

The general practices followed with regard to pilot plant operation are discussed. The specific items covered include: feed charge systems, various reactor systems, product recovery sys-

tems, gas metering, product scrubbing, feed stock drying, and the pumping of corrosive liquids. Flow sheets are presented for: fixed bed reactors with a jacket for heat removal; a boiler system for heating a jacketed reactor; a mixing type of reactor; and a jet type of reactor.

W. J. Merwin

Reactor Design

Wilhelm, R. H. RATE PROCESS-APPLICATION TO REACTOR DESIGN. *Chem. Eng. Progress* 45, 208-218 (1949) *March.*

Reaction rate controlling processes are analyzed in relation to reactor design. Both chemical rate and diffusion rate controlling processes are discussed in considerable detail. A catalytic converter design is worked out illustrating the effect of a combination of both first order reaction and diffusion rate controlling in different parts of the system with varying temperatures.

S. Katz

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Heat Inertia

Broida, V. "HEAT INERTIA" IN PROBLEMS OF AUTOMATIC CONTROL OF TEMPERATURE. *Instruments* 22, 136-138, 160-164, 166 (1949) *February.*

The author introduces the concepts of "heat inertia" and fictitious mass in connection with automatic temperature control, using the analogy of the fly-wheel. A general expression is derived for the variation of temperature inside a heating unit as a function of time. In this article, the first of a series, the author shows how this general expression is applied to discontinuous automatic control systems, such as on-off, high-low, and successive multiple step control.

W. J. Merwin

Broida, V. "HEAT INERTIA" IN PROBLEMS OF AUTOMATIC CONTROL OF TEMPERATURE. *Instruments* 22, 222-224, 254, 256, 258, 260, 262, 264 (1949) *March.*

In the second article of the series, the author considers problems related to continuous automatic control systems, such as floating control with automatic reset, positioning control with throttling action, and positioning control with both throttling and automatic reset actions. The author shows how the general equation developed in the first portion of the paper applies to the above mentioned situations. Very detailed mathematical derivations involving differential equations are presented.

W. J. Merwin

Manometer

Puddington, I. E. THE DETERMINATION OF HEAVY WATER. *Can. J. Research* 27B 1-5 (1949) *January.*

A procedure for the determination of the D_2O concentration in heavy water solutions is described, based on a comparison of the vapor pressure with that of pure water. The paper includes a description of a differential mercury manometer, sensitive to pressure differences of 6×10^{-4} mm.

S. Katz

Mixing

Smith, J. C. MODERN PROCESSING REQUIRES EFFECTIVE EQUIPMENT. *Chem. Ind.* 64, 399-404 (1949) *March.*

The author describes the types of equipment available for mixing liquids in vessels. The topics covered are propellers, paddles, gates, anchors, turbines, radial propellers, cones, and discs. Special mixers such as cage beaters and homogenizers are briefly mentioned. A list of manufacturers of mixing equipment and a bibliography of literature references are presented.

W. J. Merwin

Thermocouples

Potter, R. D. and Grant, N. J. TUNGSTEN-MOLYBDENUM THERMOCOUPLES. *Iron Age* **163**, 65-69 (1949) *March* 31.

The range of satisfactory service for tungsten-molybdenum thermocouples has been extended to 3990°F., a few readings being obtained as high as 4530°F. The couples consisted of .02 in. diameter wire, the hot junction of which was welded in a carbon arc without a flux, with the thermocouple connected to one side of the arc. The necessary annealing was carried out in hydrogen at 3630°F for one minute, the couple being heated by its own resistance to passage of an electric current. Calibration was by comparison with a platinum, platinum-rhodium couple and an optical pyrometer. The calibration curve was found to be substantially a straight line above 2700°F, with a slope of 0.375 mv. per 100°F. Since the couples are susceptible to contamination, best results were secured with the use of a protection tip of stabilized TANI zirconia to which a fused quartz tube was fastened, argon being circulated through the tubes.

W. E. Ball

12. MATERIALS OF CONSTRUCTION

Corrosion

Pourbaix, M. CORROSION, PASSIVITY AND PASSIVATION FROM THE THERMODYNAMIC POINT OF VIEW. *Corrosion* **5**, 121-133 (1949) *April.*

A stepwise method of establishing an equilibrium diagram of potential versus pH for the system Fe-H_2O based upon thermodynamic expression of equilibrium is discussed. Experimental evidence is presented which verifies the techniques employed. Similar equilibrium diagrams for the systems Cu-H_2O and Cr-H_2O are given. The equations which bound the areas of passivity and passivation on the equilibrium diagram are explained.

B. E. Hunt

FIRST STEPS IN INSTALLING CATHODIC PROTECTION. *Am. Gas Assoc. Monthly* **31**, 32-33, 38 (1949) *April.*

This is the first of a series of short articles on the fundamentals of corrosion prevention initiated by the American Gas Association Corrosion Committee. The preliminary steps in installing cathodic protection are discussed as follows: (1) soil surveys; (2) selection of current source; (3) design of cathodic protection installation; (4) construction standards; (5) field installations; and (6) preparation of operating and maintenance procedures.

B. E. Hunt

THE UNDERGROUND CORROSION OF LEAD ZINC AND GALVANIZED MATERIALS. *Ind. Finishing* **1949**, 444-445 *(February).* The results of burial tests in various types of soils upon the corrosion of zinc, lead, iron, and galvanized iron are discussed. The effect of different aeration and of the organic and inorganic acidity of soil upon the corrosion of lead are discussed. The inhibitive powers of sulfates and chlorides on the corrosion of lead is illustrated.

B. E. Hunt

CATHODIC PROTECTION OF BURIED METALLIC STRUCTURES AGAINST CORROSION. *Pipe Line News* **1949**, 18-19 *(April).* See *Gas Abstracts* **4**, 206 (1948) October for abstract.

Refractories

PROPERTIES AND USES OF PURE OXIDE HEAVY REFRACTORIES. *Ind. Heating* **16**, 496, 498 (1949) *March.*

Properties of high temperature refractories are compared as to their applicability in industry. These refractories are the pure oxides of alumina, magnesia, zirconia, beryllia, and thoria. The former three are discussed more fully as they are quite frequently used.

S. Mori

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